

ABSTRACT

The invention relates to methods and compositions which utilize the emission of light to monitor changes in microenvironments involving cells. The invention is especially useful for monitoring exocytotic activity such as detecting quantal release of synaptic vesicles. Fusion proteins of *Cypridina* luciferase and synaptotagmin-I or VAMP/synaptobrevin-2 were targeted to synaptic vesicles and, upon exocytosis, formed light-emitting complexes with luciferin present in the extracellular medium. Photon emissions in the presence of a depolarizing stimulus can be observed with these systems. pH-sensitive mutants of green fluorescent protein are also provided, which are useful for visualizing exocytosis and for imaging and measuring the pH of intracellular compartments.